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Contributions of Charles S. Peirce to Creative Thinking*

Contribuições de Charles S. Peirce para o Pensamento Criativo

Abstract

The thought of Charles S. Peirce can provide new keys for the study of creativity. It is possible to argue, based on the pragmatism that Peirce defended, that there is a form of reasoning that joins logical soundness and imagination. Peirce's scientific method, whose power lies in a logical operation called abduction, provides important clues to better understand how we make new discoveries, how we embody new ideas in creations and, ultimately, how we think more creatively and effectively.

Keywords

Peirce. Creativity. Abduction. Method. Imagination.

Resumo

O pensamento de Charles S. Peirce pode fornecer novas chaves para o estudo da criatividade. É possível argumentar, com base no pragmatismo defendido por Peirce, que existe uma forma de raciocínio que une solidez lógica e imaginação. O método científico de Peirce, cujo poder está em uma operação lógica chamada abdução, fornece pistas importantes para entender melhor como fazemos novas descobertas, como incorporamos novas ideias em criações e, em última análise, como pensamos de forma mais criativa e eficaz.

Palavras-chave

Peirce. Criatividade. Abdução. Metodologia. Imaginação

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Creativity is something more than the superficial vision that fashionable handbooks or self-help books sometimes offer. Contrary to long-standing prejudices and stereotypes, creativity is not at odds with depth of content, with educational discipline or with being accurate. In order to improve creativity, a sound theoretical basis is required, and that basis can be traced from the thought of Charles S. Peirce. It is possible to develop, on the basis of pragmatism, a kind of thought – imaginative and rigorous at the same time – which allows the potential of each person to flourish, and which has as its purpose the holistic growth of human beings.

The pragmatism of Charles S. Peirce, in contrast to misinterpretations that stress the useful or practical character of actions, seeks to understand human beings in relation to their actions and that to which actions may lead, that is, in relation to the conceivable consequences. The creativity of this way of thinking lies therefore in the possibility of developing new courses of action with the help of imagination, in our ability to develop our conceptions in different ways, that is, the signs that make us able to know the world around us and to make that world grow. Pragmatism has to do precisely with learning from experience, transforming it until doubt turns into belief in a process that can be evaluated from a practical point of view (Chiasson, 2001, ix); pragmatism has to do with reason in a more effective way.

Creativity, which is nothing other than the possibility of growing that soaks everything, the capacity to generate new intelligibility, is a central issue in Peirce's thought. Besides being a topic that he directly addresses in the methodological realm, creativity is a nerve that runs through and gives life to Peirce's philosophical system. Everything, both the universe and human beings, is for him subject to constant evolution and growth, to the constant actualization of possibilities. In this article, I will leave aside the metaphysical aspects of creativity in order to focus on certain issues arising from Peircean scientific methodology that can provide important clues for developing creative thinking. This can help to understand how humans are able to carry out their proper function: to embody general ideas in art-creations, in utilities and in theoretical cognition (CP 6.476, 1908).

The engine of creativity in Peirce is none other than abduction, a peculiar operation of the mind that combines logical rigor and imagination. It is possible, using abduction, to achieve thorough and effective thinking, while being creative at the same time. In this article I will first explain the main features that something must have in order to be considered creative; I will focus after that

on the specific methodology of Peirce, because any improvement in creative thinking requires a sound understanding of how new discoveries are made. Next, I will explain in more detail the role and nature of abduction, and will conclude by focusing on certain keys for fostering creativity and removing barriers to creative thinking.

I. WHAT IS CREATIVITY?

It is important to note, first of all, that creativity is not incompatible with content or discipline. On the contrary, creativity has to do with exercising certain capacities and with promoting better reasoning, which will help us in any learning process, in expressing ourselves and in numerous situations of everyday life. Creative teaching, for example, is not that which takes the teaching method more into consideration while downplaying the content, but one in which students effectively internalize what they are learning and can therefore use the content in creative ways. Creativity is an answer, a way of expression that is only able to develop the person that has something to say or something to solve, and therefore it requires content and sufficient effort.

For Peirce something creative means, first, an actualization of possibilities within the continuity of thought. According to his *synechism*, Peirce argues that everything is continuous, both in the universe and in our thought. *Synechism*, Peirce writes, "means the tendency to regard everything as continuous," and he says that he carries the doctrine "so far as to maintain that continuity governs the whole domain of experience in every element of it" (CP 7565-6, 1893). All propositions are continuous with experience and with other propositions, that is, every element of our thought is always preceded by others with which it relates, and will in turn be followed by a new one. "Ideas tend to spread continually and to affect certain others which stand to them in a peculiar relation of affectability," writes Peirce (CP 6.104, 1891). We can speak of a "train of thought" which can be sketched as follows:

- Life is like a chain.
- Our thought is continuous. There are no jumps in it. Our reasoning does not come out of nowhere.
- All reasoning is preceded and followed by other instances of reasoning. *One thing leads to another*. There are no final ideas: we can never have reason to believe that any given idea will be established or disproved forever (CP 7.569, 1893).
- The continuity of thought allows us to advance step by step toward the truth. This is graphically expressed by Sherlock Holmes: "from a drop of water, a logician could infer the possibility of an Atlantic or a Niagara without having seen

or heard of one or the other" (Conan Doyle, *A Study in Scarlet*).

This association of ideas that Peirce defended in the nineteenth century is called nowadays *synectics*, and it is an important item in creative thinking. You have to pull on an idea to see the "string" of ideas behind it, although these elements, at first glance, may seem to have no relationship to each other. The successive thoughts lead us to solutions. Peircean abduction consists precisely, as will be seen later, in rearranging various elements that seem unconnected, thus linking what at first glance may seem disparate and irrelevant.

Creative thinking therefore implies a continuation of human ideas, a proceeding further in the train of thought. But that step from one thing to another has to have certain features to be creative: it must be new, intelligible, original, and valuable.

1. New. Novelty must exist by reference to something "old," for without tradition there can't be anything new: if something is completely new we can't even express it. In that sense we can speak of an "enthusiasm for the experience" of the creative person, but we must also recognize that the creator cannot simply base herself on experience: creative thinking must go beyond the limits of past knowledge. The past may seem constrictive, but it is ultimately shown to be something that somehow allows creativity, inasmuch as one can continue it.

2. Intelligible. The novelty that something creative possesses is inextricably linked to a new requirement: the work must be *intelligible* within that dialogue between old and new. It's not about what's new for the sake of newness; it must have a character, a quality that makes it possible to be recognized, identifiable. "The new thing must have a character, an identifiable principle or quality, and this character is identifiable because it seems to be something we may in the future be able to connect with other things" (Hausman, 1987, 381). Thus, a painting has something that makes it identifiable and related to a particular style, or to other styles of the past, or it may potentially be framed by future trends, or a literary work can be ascribed to a genre, etc.

3. Original. Besides novelty and intelligibility, a third feature of the creative, often mentioned, is originality. Some scholars have defined this as the ability to make connections to something that was not previously connected in this way (Boden, 1999, 369), and sometimes it is not clear where the difference lies between novelty and originality. In my understanding, speaking of originality is to put the emphasis not on the difference, but rather on being yourself, on the personal factor that is added to what is created. Originality appears, in this sense, as the ability to express oneself, to express one's own personal being. Everything in which one can recognize oneself would be creative: the originality of a work of art has to do with the ability for expression. What makes something original is not

exactly what makes it new – a difference of intelligibility – but what remains of the creator in the work of art.

4. Valuable. Creative objects or ideas, moreover, are valuable or appropriate. The creative work must have an external value; it is not a subjective phenomenon, and that makes something creative differ from a purely extravagant invention. An external result is necessary: being creative is not the same as being brilliant or witty. The artist or the scientist create something new that has real value. It is difficult to define what is valuable, but as Hausman noted, we can speak of certain conditions that demand our attention and prompt us to judge that the new thing should exist (Hausman, 1987, 382). I would like to clarify that we are not referring here only to an instrumental value. Of course what is created is good for something, for example in the history of literature or art, but the creative work must in addition have a value in itself, must be intrinsically good, in the sense that it should exist because it is what it is. For example, we say that a novel is good simply because we are delighted in reading it, we appreciate a value in it, whatever place it may take in the history of literature.

In the case of science, the value of the creative hypothesis lies in its being a successful explanation of the world. Thus, an original and novel hypothesis that is not a successful explanation can't be considered creative: scientific hypotheses must explain the facts. In the case of art, the value of the creative idea does not consist in its power to explain reality, but in its ability to express feelings that take shape and meet an initial restlessness. An artist does not seek to understand what is true nor is he aimed at discovery, but seeks to express something in a beautiful way.

We now have in our hands the first keys to understanding something creative. Experience and tradition must be taken as a starting point, and to the analysis of the different elements a personal development must be added, something that is a continuation of prior human thought and which results in something new, intelligible, original, and valuable. Next, I will discuss the specific methodology for doing so.

II. CHARLES S. PEIRCE'S METHODOLOGY

The need to choose a particular methodology in order to develop our reasoning, creations and research implies, for Peirce, that thinking is not something that just happens, but is something that we can control and improve. If a person tries to direct her own thinking and focus her first instincts, she will have a better capacity for pursuing her goals. We should all be logicians, not in the sense of being experts in formal logic, but, as Peirce said, in the sense of learning to think

rigorously, to find those classes of reasoning that, if persisted in, must eventually lead to truth about the problems they are applicable to – if not to the absolute truth then at least to an indefinite approximation (CP 2.200, c.1902). We must, says Peirce, apply to our own acquired habits of researching – or of creation – the art of logical analysis, an art as elaborate and methodical as that of a chemical analyst. We must learn to think, that is, we need to train our reason to make it more effective, because bad arguments are the basis of many misunderstandings and problems.

Therefore, to become better thinkers, and also more creative persons, we have to choose the way we will reason and respect it, without ever despising other modes of thought:

The genius of a man's logical method should be loved and revered as his bride, whom he has chosen from amongst all the world. He need not condemn the others; on the contrary, he may honor them deeply, and in doing so he only honors his chosen one the more. But she is the one that he has chosen, and he knows that he was right in making that choice. And having made it, he will work and fight for her, and will not complain that there are blows to take, hoping that there may be as many and as hard to give, and will strive to be the worthy knight and champion of her from the blaze of whose splendors he draws his inspiration and his courage (CP 5.387, 1877).

The choice of a method is therefore one of the most important decisions we can make, for it will direct our life, and though Peirce does not reject any other particular method – because he thinks the research-road must never be closed – for him the superiority of the scientific method is clear. Peirce states in his article *The Fixation of Belief* (CP 5.358-5.387, 1877) that there are four different methods that can lead to overcoming doubt and to the establishment of a belief: tenacity, authority, *a priori* method and science. Tenacity would be the method of those people who cling to their own beliefs and hold them without wavering; the method of authority would accept what others – an institution or group of people – impose on us, making us intellectual slaves; the *a priori* method is to believe what one tends to believe, that which seems true according to our own reason. For Peirce the *a priori* method is valuable, but contains an accidental element that is not based on experience or universal nature but on personal preferences, and therefore research becomes something like the development of taste. The method of science, meanwhile, is the only one that is based on experience and presupposes the existence of reality, that is, of real things that affect our senses according to regular laws, independently of our opinions. The scientific method

assumes that we can know how things are, and that anyone with enough experience and reason will come to the same conclusion. It is the only method that, since it is based on experience, makes agreement among all people possible.

Although Peirce developed his methodology in the field of science, it should not be limited only to that domain. The methodology of Peirce – what he called the “scientific method” – is much more than a way to make scientific discoveries: it actually aspires to be the right way to proceed with any research program concerning reality, that is, with any creative approach to our world. It is a tool we can all use: “Everybody uses the scientific method about a great many things, and only ceases to use it when he does not know how to apply it,” says Peirce (CP 5.384, 1877). Scientific methodology must be used, according to Peirce, in any investigation that seeks to be serious and rigorous, whatever its object. This methodology can be used even in the most creative areas of human culture, for example, in art. What is, then, this Peircean method?

a) Starting point

The method, as it is characterized by Peirce, begins with known and observed facts, after which it proceeds into the unknown. All research originates with the observation of a surprising phenomenon, in an experience that makes us abandon some expectation or a habit break. In *The Fixation of Belief*, Peirce writes that research always starts from doubt, not a methodological doubt in the Cartesian sense, but a real question – “a real and living doubt” – that arises in us through experience.

Therefore, the implementation of the thought process requires determining what it is that surprises us or what it is we notice as strange, that is, identifying that which – in our experience – is not perceived as it should be and causes us restlessness, a state of doubt which we desire to overcome. The problem to solve must be clear to us, and sometimes this will require us to redefine the problem in order to understand it better: a correct question is part of the solution. To redefine problems, sometimes it may be useful to express them in a written form, to perform an analysis of their limits, to try to express a situation metaphorically, or to ask simple questions such as when, where, etc.

From this starting point, the three stages of the scientific method, strictly speaking, develop.

b) Initial or abductive stage: (we seek a hypothesis)

This phase involves the search for and development of an initial hypothesis. From the observations and surprising facts, a conjecture that provides a possible explanation arises. This means, as Peirce states, that a syllogism arises that shows the surprising fact as necessarily resulting from the circumstances of its occurrence along with the truth of the credible conjecture as premises.

In this stage we don't have a particular theory in mind, though surprising facts make us feel that a theory is needed to explain them.

c) Intermediate or deductive stage: (we seek consequences)

The initial hypothesis must be tested. This test, says Peirce, "to be logically valid must honestly start, not as abduction starts, with scrutiny of the phenomena, but with examination of the hypothesis, and a muster of all sorts of conditional experiential consequences which would follow from its truth" (CP 6.470, 1908). The second stage of the research therefore consists in collecting the possible consequences of the hypothesis. This stage is carried out by logical analysis.

d) Final or inductive stage (we seek facts)

The purpose of Deduction, that of collecting consequents of the hypothesis, having been sufficiently carried out, the inquiry enters upon its third stage, that of ascertaining how far those consequents accord with Experience, and of judging accordingly whether the hypothesis is sensibly correct, or requires some inessential modification, or else must be entirely rejected (CP 6.472, 1908).

This final stage starts from a hypothesis that seems to recommend itself because of its possible consequences. We feel that facts are needed to support the hypothesis, and the study of it will suggest the experiments needed.

We can only grant a significant value to the creative hypothesis after induction. "Deduction proves that something *must* be; Induction shows that something *actually* is operative; Abduction merely suggests that something *may be*" (CP 5.171, 1903). In order to think more effectively, we must learn to reason abductively, deductively and inductively, that is, we must learn to come up with conjectures or possible explanations, to develop the consequences that would follow from adopting one point of view or another, and to verify those consequences in practice. We must learn to generate new possibilities and to reason while taking into consideration the consequences that would necessarily follow from our actions.

III. ABDUCTION: MOTOR OF CREATIVITY

For Peirce, abduction is the most important stage of his method, since it would be impossible to obtain new knowledge without it. Abduction is "the only logical operation which introduces any new idea" (CP 5.171, 1903).

Peirce holds the premise that *we cannot discover the truth by chance*; it would be impossible, says Peirce, to guess the right hypothesis among the infinity of possible hypotheses only by chance. There must be some capacity that makes us be right quite often. How did a chemist, for example, ever come up with a correct theory about nature, asks Peirce in 1903. He answers:

You cannot say that it happened by chance, because the possible theories, if not strictly innumerable, at any rate exceed a trillion – or the third power of a million; and therefore, the chances are too overwhelmingly against the single true theory in the twenty or thirty thousand years during which man has been a thinking animal, ever having come into any man's head. (CP 5.591, 1903)

The human mind has a natural adaptation for imagining correct theories (CP 5.591, 1903) that is expressed through abduction. We owe to it every discovery and every creation. "Not the smallest advance can be made in knowledge beyond the stage of vacant staring without making an abduction at every step" (MS 692, 1901), writes Peirce. He attributed to abduction the emergence of the first idea, in which the full force of the creative advance is already contained. Abduction is directly responsible for discovery, and it constitutes the beginning of a process that culminates with a scientific achievement.

The explanation of this process of discovery may not, for Peirce, be purely psychological: "let me tell you that all the psychology in the world will leave the logical problem just where it was" (CP 5.172, 1903). This process is structured and susceptible to logical explanation: "there is a purely logical doctrine of how discovery must take place, which, however great or little is its importance, it is my plain task and duty here to explore" (CP 2.107, c.1902). Hull has affirmed that achieving a harmony between creativity and logic was one of Peirce's underlying philosophical tasks, and in order to do so he had to reformulate logic itself in a radical way (Hull, 1994, 271). Abduction is one of the key issues for this reformulation. The special nature of abduction turns the logical process leading to discovery – without ceasing to be logical – into a mixture of several factors, not just rationality, that explain the surprising and unexpected nature of the new finding. Among these factors are imagination and instinct, without which we could not

come up with possible solutions nor hit on the hypothesis that has the best fit. So, creativity and logic are not mutually excluding: creative thinking can combine imagination and logical rigor thanks to abduction.

The methodological and logical aspect of the creative process implies that, in a way, it can be learned and developed, although it is not an exact process. The creative capacity of human beings can be developed through identifying the steps of the most appropriate method, as I have already explained, and improving the capacity of abduction. I will now try to explain in a bit more detail what that abductive capacity consists in.

Abduction, according to Peirce, "consists in examining a mass of facts and in allowing these facts to suggest a theory" (CP 8.209, 1905). An example of abduction would be the doctor who considers a patient's symptoms "surprising." The doctor takes note of these symptoms and tries to find a diagnosis in which his vision is expanded, and the symptoms he reported appear to be the result of an inferred disease. This is only possible if he finds in his knowledge something that can explain the results that are presented and that are displayed in light of the hypothesis as a case of something. Abduction provides an explanation from a broader point of view on what happens ("your symptoms are a case of..."), and it needs more than medical knowledge: it also needs the ability of the doctor to relate medical signs and symptoms that originally appeared unconnected.

Further examples of abduction are the detectives who, like Sherlock Holmes or Auguste Dupin, solve an enigma from a few clues. Although detective powers have traditionally been attributed to deduction, we argue, following Peirce, that they are actually clear instances of abduction, that is, of reasoning by conjecture.

In addition to medical and detective procedures, there are other examples of abduction that Peirce himself provided:

I once landed at a seaport in a Turkish province; and, as I was walking up to the house which I was to visit, I met a man upon horseback, surrounded by four horsemen holding a canopy over his head. As the governor of the province was the only personage I could think of who would be so greatly honored, I inferred that this was he. This was an hypothesis. Fossils are found; say, remains like those of fishes, but far in the interior of the country. To explain the phenomenon, we suppose the sea once washed over this land. This is another hypothesis. (CP 2.625, 1893)

Abduction therefore means formulating an explanatory guess that involves novelty. Certain features of this mode of reasoning, some of them already mentioned, will be summarized in what follows:

1. *Abduction would not be possible without prior knowledge.* Such **knowledge** makes the conclusion possible, even though the conclusion is not determined by it. Peirce claims that abduction has an original character (CP 5.181, 1903), since the novel conclusion is not contained in the premises. Abduction discovers unique or unusual relationships between things and existing ideas:

The abductive suggestion comes to us like a flash. It is an act of insight, although extremely fallible insight. It is true that the different elements of the hypothesis were in our minds before; but it is the idea of putting together what we had never before dreamed of putting together which flashes the new suggestion before our contemplation. (CP 5.181, 1903)

2. *Abduction has a logical form*, which Peirce describes as follows: "The surprising fact, C, is observed; But if A were true, C would be a matter of course. Hence, there is reason to suspect that A is true" (CP 5.189, 1903).

3. *Abduction starts in surprise*: "It is by surprises that experience teaches all she deigns to teach us" (CP 5.51, 1903). Something that is already present and surprising leads to a possible explanation that opens doors to the future, to further knowledge. Learning is a process of allowing facts to surprise us and of originating ideas to explain what surprises us. In abduction we believe that the strange and unusual fact that we have observed may be the result of a general law, that is, although the fact observed is singular, it puts us on the track of something general. If our conjecture is true, our knowledge will be expanded.

4. *The abductive capacity means being able to reason backwards.* From a result, we are able to develop the steps that have led us to that result. Although sometimes an hypothesis seems to arise in an almost magical way, we can provide a posteriori an explanation of how we got there, which paths we have followed, although perhaps in a not entirely conscious way.

Correct hypotheses are therefore the result of a process, although a process not conscious enough to be controlled or, to put it more aptly, a non-controllable and therefore not entirely conscious process. But that seemingly magical ability is rational, logical and creative at the same time; it combines logical rigor with imagination to invent possible explanations. The abductive capacity plays an essential role in science, but also in other subjects, even in all the decisions we make in life. Abduction is equally important in art, which seeks something that has the nature of a discovery, and which, like all discoveries, occurs for Peirce through abduction, which frees us to explain the unexplainable, without any other limit than that of imagination.

IV. HOW TO ENCOURAGE CREATIVITY

As we have said, to encourage creative thinking one has to improve abductive capacity; that is, to be able to reason from the given facts devising possible solutions and alternatives, broader ways of thinking, new perspectives that include what has been experienced and give it a meaning. We must then pay attention to the following points:

1. Be aware that we can improve our processes of reasoning.

To learn how to think more creatively and effectively the first thing to do is to want to do it, that is, to realize that we do not yet know how to think. It is a fact that we think, but we can learn to think better. Peirce argued that there is a *logica docens* and a *logica utens* (CP 2.186-190, c.1902).

- *Logica utens* is a "homespun" logic, a rudimentary sense of logic that we all use, a general method by which everyone obtains truths, even without being aware of doing so and without being able to specify what their method was. Peirce wrote: "You think that your *logica utens* is more or less unsatisfactory. But you do not doubt that there is *some* truth in it" (CP 2.192, c.1902).

- *Logica docens* is a more sophisticated logic practiced by logicians and scientists, doctors, detectives, and experts that can be taught and learned consciously. It is a method developed to uncover the truth and think better.

Our task then is to move from *logica utens* to *logica docens*, to develop our natural logic and become aware of our thought processes in order to improve them.

2. Learn to find possible explanations for things.

We usually think of Sherlock Holmes as a bloodhound. This is the description that Watson gives of Holmes' transformation when he was following a clue:

Men who had only known the quiet thinker and logician of Baker Street would have failed to recognize him. [...] His nostrils seemed to dilate with a purely animal lust for the chase, and his mind was so absolutely concentrated upon the matter before him that a question or remark fell unheeded upon his ears, or, at the most, only provoked a quick, impatient snarl in reply." (CONAN DOYLE, *The Boscombe Valley Mystery*)

Without reaching the level of Sherlock Holmes, we can all develop our abductive and detective skills, and apply them not only in our research but also in our daily lives. We can teach our mind to find the conscious and unconscious clues that lead us to devise possible solutions for the problems that we face. It is important that we use our abilities to think of possible explanations, not only for great mysteries but also for mysteries of ordinary life.

3. Learn to broaden our perspective.

To make good guesses we need some distance, that is, to look beyond what is before our eyes. Sometimes, we also need to change our mental constructs and find more than a single type of response. Sometimes, it may be useful to not dedicate all one's attention to the matter at hand, but to let it get out of focus. It is necessary, wrote Edgar Allan Poe in a text that we know that Peirce read (CP 6.460, 1908), not to look straight ahead:

Vidocq, for example, was a good guesser, and a persevering man. But, without educated thought, he erred continually wandered by an excessive ardor of his research. He damaged his vision by the very intensity of his investigations. He impaired his vision by holding the object too close. He might see, perhaps, one or two points with unusual clearness, but in so doing he necessarily lost sight of the matter as a whole. Thus, there is such a thing as being too profound. Truth is not always in a well. In fact, as regards the more important knowledge, I do believe that she is invariably superficial. The depth lies in the valleys where we seek her, and not upon the mountain-tops where she is found. The modes and sources of this kind of error are well typified in the contemplation of the heavenly bodies. To look at a star by glances, to view it in a side-long way, by turning toward it the exterior portions of the retina (more susceptible of feeble impressions of light than the interior) is to behold the star distinctly, is to have the best appreciation of its lustre, a lustre which grows dim just in proportion as we turn our vision fully upon it. (ALLAN POE, *The Murders in the Rue Morgue*)

There is a very useful tool to defocus our attention, introduce new perspectives and develop the imagination, which both Peirce and John Dewey recommended. Peirce called that tool musement; it could also be called daydreaming or mental game. Letting the mind wander is usually a good technique for introducing new perspectives on an issue. Encouraging this "play" with ideas, developing concepts in their logical implications of interdependence and relationships – without any

reference to their application or their real existence – that is, the development of a conceptual map, has great benefits. This is to promote a constructive play, at times unconscious, with meanings and relationships (Dewey, 1933, 262). In musement the mind goes free, loose, from one thing to another, without following any rules. Peirce characterizes it as a purposeless play of mind: "it involves no purpose save that of casting aside all serious purpose." It has no rules, "except this very law of liberty" (CP 6.458, 1908). Musement is not limited to scientific study or logical analysis: "I should lament to find anybody confining it to a method of such moderate fertility as logical analysis" (CP 6.461, 1908). It is precisely the non-reduction to science or logic which gives it much wider possibilities (CP 6.461, 1908).

Musement is a mental state of free speculation, without limitation of any kind, In which the mind plays with ideas and can dialogue with what is perceived, in a dialogue made up not only of words but also of images, a dialogue in which imagination plays an essential role:

Enter your skiff of Musement, push off into the lake of thought, and leave the breath of heaven to swell your sail. With your eyes open, awake to what is about or within you, and open conversation with yourself; for such is all meditation. It is, however, not a conversation in words alone, but is illustrated, like a lecture, with diagrams and with experiment. (CP 6.461, 1908)

Singer has written that much of the imaginative activity takes the form of daydreaming, which can be considered very similar to the Peircean *musement*:

Much of imaginative thought takes the form of daydreaming, which usually involves shifts of attention away from an immediate task or concrete mental problem to seemingly task-unrelated images or thought sequences. Such daydreams may range from memories to wishful future events, or to playful story-like reshaping of current concerns of the individual or of long-standing desires. (SINGER, 1999, 14)

Musement, this peculiar daydreaming, a wandering of the mind, is a unique imaginative experience that will enable abduction to arise. In order to be more creative, we should give to our minds the time and the possibility of "wandering" and exploring new possibilities.

4. Develop our powers of observation

In order to improve our logical and creative thinking, we must learn to be observant people. Peirce took time to train his faculties of perception and attached great importance to the ability of being impressed, since the feelings that things cause in us will be combined later with an imaginative and rational development. In Peirce's scientific methodology that "impressionist" aspect of observation is highly meaningful, since abduction is grounded on a variety of impressions derived from experience that somehow are shaped and become a rational hypothesis. Observation, often unconscious, is also the most important in practical reasoning (RLT, 182).

The powers of observation is critical for reasoning, and can be improved. Just as an untrained person can get in shape with regular exercise, says Peirce, a person whose powers of observation have been lost through lack of use can also obtain amazing results by analogous exercises (RLT, 183). Peirce writes:

I've been through a systematic process of training to recognize my feelings. I worked intensively for many hours a day every day for many years to train myself in this; and is a workout I recommend you all. The artist has such training. (CP 5.112, 1903)

The observation of data and the development of our perceptual abilities become therefore critically important for following a correct methodology. You must be aware not only of the most obvious, of the things everyone sees, but also of smaller things, those little details that are often overlooked:

"By an examination of the ground I gained the trifling details which I gave to that imbecile Lestrade [Scotland Yard inspector], as to the personality of the criminal."

"But how did you gain them?"

"You know my method. It is founded upon the observation of trifles."

(CONAN DOYLE, *The Boscombe Valley Mystery*)

The cause of the failures of the police in many Sherlock Holmes stories is that they tend to adopt the hypothesis that would more probably explain a few striking facts, ignoring the trifles and rejecting the data that would not support their initial hypothesis, but where however may lie the solution: "There is nothing more deceptive than an obvious fact."

For a good observation is essential to see that which is before us, to see it such as it is, as present, without being replaced by any interpretation, and without allowing any circumstance that could change it. *Sometimes we do not see what is before our eyes, but what should be*, since our gaze is conditioned by prejudices, by preconceived ideas, or by that which we hope to see.

When the ground is covered by snow on which the sun shines brightly except where shadows fall, if you ask any ordinary man what its color appears to be, he will tell you white, pure white, whiter in the sunlight, a little greyish in the shadow. But that is not what is before his eyes that he is describing; it is his theory of what ought to be seen. The artist will tell him that the shadows are not grey but a dull blue and that the snow in the sunshine is of a rich yellow. (CP 5.42, 1903)

We must look at the world with a gaze free of prejudices, and we must let experience talk to us, realizing that we must not only see the data but also the absence of data. We must perceive the experience such as it is, and then be aware of the gaps in it so as to fill them in.

5. Imagine what may be the truth

"It is not too much to say," wrote Peirce, "that next after the passion to learn there is no quality so indispensable to the successful prosecution of science as imagination" (CP 1.47, c.1896). Imagination has been defined as the "ability of the individual to reproduce images or concepts derived originally from the basic senses, but now reflected in one's consciousness as memories, fantasies or future plans" (Singer, 1999, 13). Imagination is able to form images not subject to the here and now of perception, and is able also to freely combine representative contents to build new forms.

Against the repression of rationalist positions, it can be said that imagination allows us to sort the complexity of experience and of the world in which we live; it allows us to face our communicative relationships with others and to develop the openness belonging to human personality. Everything happens in our imagination, and everything goes through it; its role is essential to understanding human rationality. The big question then is how to feed our *imagination*?

Part of the difficulty of feeding the imagination is, as Cuffaro said, the intangible character of that which we have to feed (Cuffaro, 1995, 96). However, imagination can and should be trained. Imagination can be improved through practice, by engaging in real and, above all, mental experiments, creating internal situations in which we ask ourselves "what would I do if ...," devising hypotheses, interpretations, and learning to see the meaning behind things and facts.

Besides *musement*, already mentioned in the third point of this section, reading and writing are also great tools that allow us to explore new possibilities. We have to get used to imaginatively exploring what it means in terms of possibilities to perform this or that action, to analyzing possible implications and applications of facts. Teaching someone to reason is not just teaching her to reach conclusions, but also teaching to create opportunities.

An impoverished imagination makes us unable to cope with our problems because we cannot overcome a flat perspective; it impairs human relationships because we cannot put ourselves in the shoes of the other person; and it also prevents us from appreciating the various dimensions of experience, from enjoying artistic expression, etc. Imagination gives us the freedom to escape from an isolated and impoverished life, to grow, and to transform and enrich our own experience.

We need good abductors, and for that it is necessary to make imagination grow through the exploration of possibilities, together with free play with ideas. Einstein said that imagination is more important than knowledge. Contrary to what we might think, it is through this apparent imaginative rambling, whose trail sometimes leads us far from our topic, that the logical mind reaches its maximum efficiency.

6. Select the simplest and most natural explanation.

In 1908, Peirce wrote: "Modern science has been built after the model of Galileo, who founded it, on *il lume naturale*. That truly inspired prophet had said that, of two hypotheses, the simpler is to be preferred," but not simple in the sense of "logically simple" but "the simpler hypothesis in the sense of the more facile and natural, the one that instinct suggests," the one that adds less to the observed (CP 6.477, 1908).

The solution appears to us as the most reasonable and simple one, in the circumstances. Peirce wrote:

Science will cease to progress if ever we shall reach the point where there is no longer an infinite saving of expense in experimentation to be effected by care that our hypotheses are such as naturally recommend themselves to the mind, and make upon us the impression of simplicity, which here means facility of comprehension by the human mind, of aptness, of reasonableness, of good sense. (CP 7.220, 1901)

How do we know which hypothesis is simpler and better? It is clear, wrote Peirce in 1901, that three considerations should determine our choice of a hypothesis.

1. It must be capable of being subjected to experimental testing. "It must consist of experiential consequences with only so much logical cement as is needed to render them rational" (CP 7.220, 1901). "Experimental testing" doesn't just mean laboratory testing; rather, it encompasses all those procedures – in a broader sense—by which a hypothesis can be compared to experience.

2. The hypothesis must be such that it will explain the surprising facts we have before us and which we are trying to rationalize. "This explanation," Peirce wrote, "may consist in making the observed facts natural chance results, as the kinetical theory of gases explains facts; or it may render the facts necessary, and in the latter case as implicitly asserting them or as the ground for a mathematical demonstration of their truth" (CP 7.220).

3. "In the third place, quite as necessary a consideration as either of those I have mentioned, in view of the fact that the true hypothesis is only one out of innumerable possible false ones, in view, too, of the enormous expensiveness of experimentation in money, time, energy, and thought, is the consideration of economy." Peirce goes on: "if a hypothesis can be put to the test of experiment with very little expense of any kind, that should be regarded as a recommendation for giving it precedence in the inductive procedure. For even if it be barely admissible for other reasons, still it may clear the ground to have disposed of it (CP 7.220)." In this sense, a hypothesis that is easily disposable can also be very helpful.

If we follow the above steps, asserted Peirce, we can easily arrive at the correct hypothesis:

The history of science proves that when the phenomena were properly analyzed, upon fundamental points, at least, it has seldom been necessary to try more than two or three hypotheses made by clear genius before the right one was found. (...) We cannot go so far as to say that high human intelligence is more often right than wrong in its guesses; but we can say that, after due analysis, and unswerved by prepossessions, it has been, and no doubt will be, not very many times more likely to be wrong than right. (CP 7.220)

The proper analysis of a hypothesis involves not being swayed only by what seems "plausible" to us, but always considering also the three factors quoted.

7. Think about the possible consequences

Although new ideas sometimes dazzle us, we must not forget that the first hypotheses, however correct we feel they are, are just that: hypotheses. We should never neglect the deductive and inductive stages of the methodology, either in science or in art or in everyday life. Only after those stages can our ideas possess value as truth.

The proper method of research involves learning to think about the consequences of actions and facts, analyzing and separating their components, and then trying to check them one by one, to gather enough convincing support.

Peirce's pragmatism maintained that the idea of something is the idea of its effects, a conviction that ought to be very present in the method we follow. The meaning of an intellectual concept is determined by the practical consequences of that concept. Recognizing a concept under its various disguises, or a mere logical analysis, is not sufficient to understand that concept: it is necessary to reach a third degree of clarity that can only be obtained through the practical effects of the concept. This pragmatist conviction is precisely what reveals for us the possibility of and the need to be creative, for imagination and creativity are indispensable for ascertaining the possible consequences of something, the facts to which it may lead, and to devise possible paths for further action.

Although pragmatism started as a logical method for clarifying concepts, it became a whole way of thinking about investigation, knowledge and human progress toward truth. In this Peircean conception, we find that neither the universe nor human life are already done or finished; rather, they are something open that has to be developed in the future, thereby supporting a creative vision.

8. Remember that creativity needs hard work

Creativity is often associated with spontaneity, but as Peirce stated, it is not realized without prior knowledge and experience: "The scientific man hangs upon the lips of nature, in order to learn wherein he is ignorant and mistaken: the whole character of the scientific procedure springs from that disposition" (CP 8.118, s.f.). Each thought is a sign for a posterior one; each reasoning involves another reasoning, and creative abduction needs experience to begin: "The order of the march of suggestion in abduction is from experience to hypothesis (CP 2.755, c.1905)."

Contrary to what is sometimes thought, good ideas do not come out of nowhere. *Good ideas do not come without a lot of previous work.*

In order to be creative, we must avoid improvisation and superficiality. One thing is efficiency and speed of thought, and another improvisation. Sometimes we talk about *serendipity*, that is, to discover things by chance. However, this can only happen when the mind is sufficiently prepared.

CONCLUSION

"Do not block the way of inquiry," Peirce wrote. "To barricade the road of further advance toward the truth," he said, "is the only unpardonable offense in reasoning" (CP 1.135-6, c.1899).

What are the main barriers that can hinder creative thinking and therefore investigation?

- Absolute assertion: to think that we own the truth, that things have reached their perfect formulation.

That we can be sure of nothing in science is an ancient truth. The Academy taught it. Yet science has been infested with overconfident assertion, especially on the part of the third-rate and fourth-rate men, who have been more concerned with teaching than with learning, at all times (CP 1.137, c.1899).

- Maintaining that some things never can be known or can never be carried out.

It is easy enough to mention a question the answer to which is not known to me today. But to aver that that answer will not be known tomorrow is somewhat risky; for oftentimes it is precisely the least expected truth which is turned up under the ploughshare of research (CP 1.138, c.1899).

- Laziness.
- Narrow vision: to resist changes of mind.
- Searching for a single answer.
- Not seeing the obvious (that which is transparent to us).
- Fear of ridicule.
- Fear of failure.
- Inability to self-criticize
- Judging something instead of just looking.

It must be said that we *cannot be absolutely sure of anything, and that there is nothing unknowable or inexplicable*. Although we can't reach absolute truth, we can take important steps on the road to knowing how things are and to invent new possibilities, as long as we want to do so:

Inquiry of every type, fully carried out, has the vital power of self-correction and of growth. This is a property so deeply saturating its inmost nature that it may truly be said that there is but one thing needful for learning the truth, and that is a hearty and active desire to learn what is true. If you really want to learn the truth, you will, by however devious a path, be surely led into the way of truth, at last. No matter how erroneous your ideas of the method may be at first, you will be forced at length to correct them so long as your activity is moved by that sincere desire. (CP 5.582, 1898)

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